

CLAIMS

What is claimed is:

1. A method for controlling the liquid-phase fuel penetration distance of fuel in an engine having direct fuel injection into a combustion chamber of the engine, said method comprising:
  - providing a source of liquid fuel for said engine;
  - injecting fuel from said source of liquid fuel through at least one injector into the combustion chamber of the engine;
  - determining at least one contemporary operating parameter of the engine;
  - determining a desirable liquid phase penetration distance for fuel injected into the combustion chamber of said engine based on said determined at least one contemporary operating parameter of the engine;
  - controllably heating fuel provided by said source of liquid fuel prior to injection into the combustion chamber of said engine and altering the liquid-phase penetration distance of said fuel into the combustion chamber of said engine in response to the determined desirable liquid phase penetration distance for liquid fuel injected into the combustion chamber of said engine.

1           2.     The method, as set forth in Claim 1, wherein said determining at least one  
2           operating parameter of the engine includes determining at least one contemporary  
3           operating parameter of the engine selected from the group consisting of fuel  
4           composition, fuel injector geometry, fuel injection pressure, combustion mode and  
5           thermodynamic conditions existent in the combustion chamber of said engine.

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7           3.     An apparatus for controlling liquid-phase fuel penetration distance in an  
8           engine having direct fuel injection into a combustion chamber of the engine, said  
9           apparatus comprising:

10               a source of liquid fuel in fluid communication with the combustion chamber  
11           of said engine;

12               a programmable electronic controller adapted to generate a fuel temperature  
13           control signal correlative of at least one contemporary operating parameter of said  
14           engine; and,

15               a means for controllably heating said liquid fuel prior to injection into the  
16           combustion chamber of said engine in response to said fuel temperature control  
17           signal, said means being disposed between said source of liquid fuel and said  
18           combustion chamber of the engine and in thermal communication with said liquid

1 fuel prior to injection into the combustion chamber of the engine.

2 4. The apparatus, as set forth in Claim 3, wherein the fuel temperature control  
3 signal correlative of at least one contemporary operating parameter of said engine is  
4 correlative of at least one contemporary operating parameter of the engine selected  
5 from the group consisting of fuel composition, fuel injector geometry, fuel injection  
6 pressure, combustion mode and thermodynamic conditions existent in the  
7 combustion chamber of said engine.

8  
9 5. The apparatus, as set forth in Claim 3, wherein said means for controllably  
10 heating said liquid fuel prior to injection into the combustion chamber of said engine  
11 includes an electrical resistance heater in thermal communication with said liquid  
12 fuel.

13  
14 6. The apparatus , as set forth in Claim 3, wherein said apparatus includes a  
15 temperature sensor in electrical communication with said programmable electronic  
16 controller and adapted to measure the temperature of heated liquid fuel prior to  
17 injection into the combustion chamber of said engine.